REPORT DOCUMENTATION PAGE

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1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From - To)
04-03-2011	Final Report	15-May-2007 - 31-Aug-2010

4. TITLE AND SUBTITLE
Modeling of Network Dynamics Under Markovian and Structural Perturbations

5a. CONTRACT NUMBER
W911NF-07-1-0283

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
611102

6. AUTHORS
Andrzej Korzeniowski, Gangaram S. Ladde

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES AND ADDRESSES
University of Texas at Arlington
Research Administration
The University of Texas at Arlington
Arlington, TX 76019 -0145

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Research Office
P.O. Box 12211
Research Triangle Park, NC 27709-2211

10. SPONSOR/MONITOR'S ACRONYM(S)
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11. SPONSOR/MONITOR'S REPORT NUMBER(S)
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12. DISTRIBUTION AVAILIBILITY STATEMENT
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13. SUPPLEMENTARY NOTES
The views, opinions and/or findings contained in this report are those of the author(s) and should not contrued as an official Department of the Army position, policy or decision, unless so designated by other documentation.

14. ABSTRACT
Our research during the third final year of funding culminated with 9 papers published [in addition to 4 and 5 papers published in the first and second year respectively], 1 accepted and 5 submitted. Aside from three specific models: Internal Structural Dynamics Model (ISDM), External Shocks Dynamics Model (ESDM) and Mixed Structural Dynamics Model (MSDM, the investigations of Random Mobile Networks and their reliability (within the framework of Network Science) have been concluded with novel results published. Applications to modeling

15. SUBJECT TERMS
Markov Dynamics, Networks, Structural Perturbation

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	15. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Andrzej Korzeniowski
UU	UU	UU	UU		19b. TELEPHONE NUMBER 817-272-3595

Report Title

Modeling of Network Dynamics Under Markovian and Structural Perturbations

ABSTRACT

Our research during the third final year of funding culminated with 9 papers published [in addition to 4 and 5 papers published in the first and second year respectively], 1 accepted and 5 submitted. Aside from three specific models: Internal Structural Dynamics Model (ISDM), External Shocks Dynamics Model (ESDM) and Mixed Structural Dynamics Model (MSDM, the investigations of Random Mobile Networks and their reliability (within the framework of Network Science) have been concluded with novel results published. Applications to modeling various phenomena in biosciences, multi-agent systems and stochastic hybrid networks were also established. Several Ph.D. students were involved in the undergoing research, with one graduating with a Ph.D. degree [in addition to 2 Ph.D. students completing their dissertations in the first two years]while others are continuing their studies on the subjects related to research initiated in this grant.

List of papers submitted or published that acknowledge ARO support during this reporting period. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Number of Papers published in peer-reviewed journals: 9.00

(b) Papers published in non-peer-reviewed journals or in conference proceedings (N/A for none)

Number of Papers published in non peer-reviewed journals: 0.00

(c) Presentations

Number of Presentations: 5.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts): 0

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts): 0

(d) Manuscripts

Number of Manuscripts: 5.00

Patents Submitted

Patents Awarded

Awards

Graduate Students

NAME	PERCENT_SUPPORTED
Daniel Siu	0.50
Jean-Claude Pedjeu	0.50
FTE Equivalent:	**1.00**
Total Number:	**2**

Names of Post Doctorates

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Faculty Supported

NAME	PERCENT_SUPPORTED	National Academy Member
Andrzej Korzeniowski	1.00	No
Gangaram Ladde	1.00	No
FTE Equivalent:	**2.00**	
Total Number:	**2**	

Names of Under Graduate students supported

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period:	0.00
The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:.....	0.00
The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:.....	0.00
Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):	0.00
Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:	0.00
The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense	0.00
The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields:	0.00

Names of Personnel receiving masters degrees

NAME
Diana Prieto-Santa
Total Number: 1

Names of personnel receiving PHDs

NAME
Ling Wu
Total Number: 1

Names of other research staff

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

Productivity of research during the third final year of funding culminated with 9 papers published, 1 accepted and 5 submitted. Aside from three specific models: Internal Structural Dynamics Model (ISDM), External Shocks Dynamics Model (ESDM) and Mixed Structural Dynamics Model (MSDM, the investigations of Random Mobile Networks and their reliability (within the framework of Network Science) have been concluded with novel results published. Applications to modeling various phenomena in biosciences, multi-agent systems and stochastic hybrid networks were also established.

Technology Transfer

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1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	March 2, 2011	Final Report: May 15, 2007 - August 31, 2010

4. TITLE AND SUBTITLE
Modeling of Network Dynamics under Markovian and Structural Perturbations

5. FUNDING NUMBERS
Grant No.
W911 NF - 07 -1 - 283

6. AUTHOR(S)
A. Korzeniowski, G.S. Ladde

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
UTA, Math Dept., Arlington, TX 76019, USF, Math Dept. Tampa, FL 33620

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U. S. Army Research Office
P.O. Box 12211
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52307 MA

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12 a. DISTRIBUTION / AVAILABILITY STATEMENT
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12 b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Our research during the final third year of funding culminated with 9 papers published, 1 accepted and 5 submitted. Aside from three specific models: Internal Structural Dynamics Model (ISDM), External Shocks Dynamics Model (ESDM) and Mixed Structural Dynamics Model (MSDM, the investigations of Random Mobile Networks and their reliability (within the framework of Network Science) have been published. Applications to modeling various phenomena in biosciences, multi-agent systems and stochastic hybrid networks were also established. Several Ph.D. students were involved in the undergoing research, with one completed and several continuing their studies.

14. SUBJECT TERMS

15. NUMBER OF PAGES
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Enclosure 1

FINAL REPORT - ARO GRANT No. W911NF-07-1-283

May 15, 2007 - August 30 2010

Drs. ***A. Korzeniowski*** (PI), ***G.S. Ladde*** (Co-PI) Proposal No. 52307-MA

Contract No.: W911NF-07-1-0283

The info below covers the period August 1, 2009 - August 31, 2010 (third year)

[*The info regarding the period May 15, 2007- July 31, 2009 (first and second year) had been submitted on August 31, 2008, and August 31, 2009 respectively*]

PUBLICATIONS

A. REFEREED JOURNALS

1. A. Korzeniowski, G.S. Ladde, On Mathematical Modeling of Hybrid Network Dynamics under Random Perturbations ***Nonlinear Analysis: Hybrid Systems***, 3 (2009), 143-149

2. G.S. Ladde, Ling Wu Stochastic Modeling and Statistical Analysis on the Price Processes, ***Nonlinear Analysis: Theory and Methods, Vol. 71(***2009), pp. v e1203-e1208.

3. J. Chandra, G.S. Ladde, Collective Behavior of Multi-agent Network Dynamic Systems under Internal and External Random Perturbations, ***Nonlinear Analysis: Real World Applications***, Vol. 11(2010) pp. 1330-1344.

4. A. Korzeniowski and G. S. Ladde, Random Networks with Interacting Nodes, ***Neural, Parallel & Scientific Computations, Vol. 18(2010), pp. 333-342.***

5. R. D. Kirby, A. G. Ladde, and G. S. Ladde, Energy Function Method for Solving Nonlinear Differential Equations, ***Dynamic Systems and Applications,*** Vol. 19(2010), pp. 335-352.

6. A. G. Ladde, G. S. Ladde, Determinant Functions and Applications to Stochastic Differential Equations, ***Comm. in Appl. Analysis, Vol. 14 (2010), pp. 409-434.***

7. G. S. Ladde, Ling Wu, Development of Nonlinear Stochastic Models by Using Stock Price Data and Basic Statistics, ***Neural, Parallel & Scientific Computations, Vol. 18(2010), pp. 269-282.***

8. A. G. Ladde, R. D. Kirby, G. S. Ladde, Stochastic Laplace Transform with Applications, ***Comm. in Appl. Analysis, Vol. 14 (2010), pp. 373-392.***

9. Divine Wanduku, G. S. Ladde, and a Two-scale Network Dynamic Model for Mobility Process, ***Mathematical Biosciences, Vol.229 (2011), pp. 1-15.***

B. ACCEPTED

1. D. P. Siu and G. S. Ladde, Stochastic Hybrid Systems with Non- and Boundary Homogeneous Jumps, ***Nonlinear Analysis: Hybrid Systems*** (to appear).

C. SUBMITTED

1. A. Korzeniowski, ***On Correlated Random Graphs***

2. A. Oprisan and A. Korzeniowski***, Large Deviations with Applications to Exit Times for switched Markov Processes***

3. G. S. Ladde and Arnut Paothong***, Dynamic Modeling and Network Processes***

4. Jean C. Pedjeu and G. S. Ladde, ***Stochastic Fractional Differential Equations: Modeling, Methods and Analysis***

5. Byron L. Griffin and G. S. Ladde, ***Qualitative Analysis of Short-Run Market***

D. EDITED

1. Founder and Editor of the "Journal of Stochastic Analysis and Applications" (with V. Lakshmikantham), Taylor & Francis, Philadelphia, PA, Vol. 28 (2010), pp. 1-1,121.

2. ***Proceedings of Neural, Parallel, and Scientific Computations*** (with M. P. Medhin and M. Sambandham), Vol. 3, Dynamic Publishers, Inc., Atlanta, Georgia, 2010

2. CONFERENCES PRESENTATIONS

A. Invited Lectures

1. G.S. Ladde, Department of Mathematics and Statistics, University of South Florida Title: "Problem Solving Process", Colloquium Lecture for Statistics Group, October 15, 2010

B. Invited Keynote Lecture at an International Conferences and Workshops

2. G.S. Ladde, Fourth International Conference on, " Neural, Parallel and Scientific

Computations", Morehouse College, Atlanta, Georgia, USA: August 11-14, 2010.

C. Invited talk at International Conference

3. A. Korzeniowski, Fourth International Conference on, " Neural, Parallel and Scientific Computations", Morehouse College, Atlanta, Georgia, USA: August 11-14, 2010.

D. Invited Lectures in National Conferences

4. A. Korzeniowski, Second Gulf Coast Conference on Probability and Statistics, USF, February 27, 2010, Tampa, FL

E. Invited Lecture at International Conference

5. G.S. Ladde, Seventh International Conference on "Differential Equations and Dynamic Systems", University of South Florida, Tampa, Florida, USA: December 15-18, 2010 (Hourly Lecture)

3. NUMBER OF Ph. D. AND MASTERS DEGREE AWARDED: **2**

A. Ph. D. DEGREE AWARDED

1. Ms. Ling Wu, Dissertation Title:"Stochastic Modeling and Statistical Analysis, Spring 2010, University of South Florida, Tampa

B. Ph. D. DEGREE RESEARCH WORK IN PROGRESS: 6

Mr. Daniel P. Siu, Dissertation Topic: "Hybrid Dynamic Processes and Applications to Risk Theory " (work in progress) University of South Florida, Tampa

Mr. Divine Wanduku, Dissertation Topic: " Stochastic Modeling of Network Centric Epidemiological Processes ", (work in progress) University of South Florida, Tampa

Mr. Jean-Claude Pedjeu, Dissertation Topic: "Stochastic and Statistical Modeling Dynamic Processes in Sciences", (work in progress) University of South Florida, Tampa.

Mr. Arnut Paothong, Dissertation Topic: "Stochastic and Statistical Dynamic modeling of Network Externality Processes", (work in progress) University of South Florida, Tampa

Ms. Jinghan Meng, Dissertation Topic: " Random Multiple-scale Dynamic Inequalities and Applications", (work in progress) University of South Florida, Tampa

Mr. Mr. Zerihun Tadesse, Dissertation Topic: "Stochastic Dynamic Model for Photosynthesis", (work in progress) University of South Florida, Tampa

M.S. DEGREE IN STATISTICS

1. Ms. Diana Prieto-Santa, Masters Project: “Stochastic Models for Pandemic Progression: Existing Approaches and New Directions, Fall 2009